PATENT ABSTRACTS OF JAPAN

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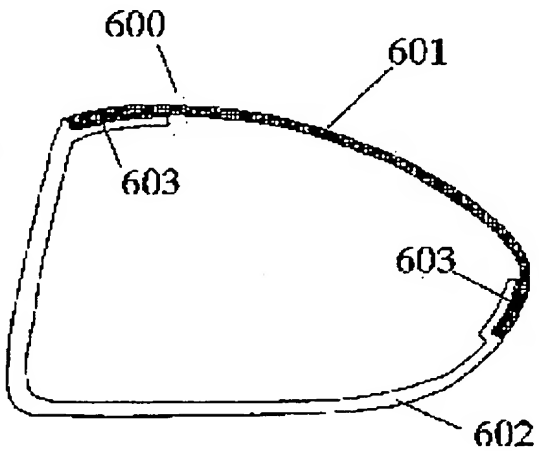
(54) GOLF CLUB HEAD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a golf club head suitable for a driver club or the like very small in curving of a hit ball and reduced in a loss of a flying distance, by forming the club head into a hollow type golf club head having sufficient performance as to strength, a striking sound and abrasion-flaw resistance of the golf club head, and having great inertia moment and a larger depth of the center of gravity.
SOLUTION: In this hollow golf club head comprising a metal material member and a fiber-reinforced resin material member, the metal material member is bonded to the fiber-reinforced resin material member via an adhesive having a thickness of 0.05-1 mm.



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CLAIMS

[Claim(s)]
[Claim 1] The golf club head which is a golf club head in the air which consists of a metallic material member and a fiber strengthening resin ingredient member, and is characterized by coming to paste up a metallic material member and a fiber strengthening resin ingredient member through adhesives with a thickness of 0.05-1mm.
[Claim 2] The golf club head according to claim 1 whose adhesives are film gestalten.
[Claim 3] The golf club head containing the base material with which the adhesives of a film gestalt consist of a nonwoven fabric or textile fabrics according to claim 2.
[Claim 4] The golf club head of claim 1-3 whose shear bond strength of adhesives is 15 or more MPas given in any 1 term.
[Claim 5] The golf club head of claim 1-4 which adhesives become from an epoxy resin component, an elastomer component, and a curing agent component given in any 1 term.
[Claim 6] The golf club head of claim 1-5 which a fiber strengthening resin ingredient member becomes from a carbon fiber strengthening epoxy resin given in any 1 term.
[Claim 7] The golf club head of claim 1-6 which a metallic material member becomes from a titanium alloy given in any 1 term.
[Claim 8] The golf club head of claim 1-7 whose volume the weight of a golf club head is 200g or less, and is 300-900 cc given in any 1 term

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a golf club head, especially a hollow wood type golf club head.
[0002]
[Description of the Prior Art] In a wood type golf club, importance is attached to flight distance and control nature. being greatly influenced by the depth (it illustrating to drawing 2) of the moment of inertia centering on the center of gravity of a golf club head or a center of gravity gets to know the flight distance and control nature of a ball -- having -- **** -- the depth of moment of inertia and a center of gravity -- weight regularity of a golf club head and weight-distribution regularity -- if -- it correlates with the volume and becomes large. The thing of the hollow type which consists only of metallic materials, such as a titanium alloy, has become in use, and a wood type golf club head is enlarged, in order to raise the volume.
[0003] To be sure, with such a golf club head, flight distance is prolonged compared with the golf club head of the solid mold represented by the former golf club head made from a persimmon, a sweet spot is also expanded, and the deflection of a hit ball is also small.
[0004]
[Problem(s) to be Solved by the Invention] Since the above-mentioned metallic material has large specific gravity, seen from a strong field, the volume of the centrum of a golf club head is increased and there is a limitation in enlarging that the moment of inertia of the whole golf club head improves, and the center-of-gravity depth.
[0005] Then, enlargement of the further golf club head is enabled as the golf club head in the air which consists of a fiber strengthening resin ingredient, especially a carbon-fiber-reinforced-plastics ingredient which is excellent in specific strength is indicated by JP,2000-51405,A.
[0006] However, the golf club head which consisted of fiber strengthening resin ingredients cannot be said to be enough compared with the golf club head made from a titanium alloy about a hit ball sound and abrasion-proof nature. Then, although the approach of joining a metal to a fiber strengthening resin ingredient, and carrying out an engine-performance improvement was mentioned, it was difficult to hold reinforcement stably around the face which an impact joins most especially in junction of a fiber strengthening resin ingredient member and a metallic material member.
[0007] Let it be the technical problem for this invention to solve the above-mentioned trouble. That is, the purpose of this invention is by considering as the golf club head of the hollow type which has sufficient engine performance about the reinforcement of a golf club head, a hit ball sound, and abrasion-proof nature, and has the depth of bigger moment of inertia and a larger center of gravity to offer the suitable golf club head for a driver with the very small deflection of a hit ball, and small loss of the flight distance by this etc.
[0008]
[Means for Solving the Problem] The summary of this invention is a golf club head in the air which consists of a metallic material member and a fiber strengthening resin ingredient member. It is the golf club head which comes to paste up a metallic material member and a fiber

strengthening resin ingredient member through adhesives with a thickness of 0.05-1mm. Preferably The base material with which the adhesives of the film gestalt whose adhesives are film gestalten consist of a nonwoven fabric or textile fabrics is included. The adhesives whose shear bond strength of adhesives is 15 or more MPas An epoxy resin component, It is the golf club head [whose volume the weight of a golf club head is 200g or less, and is 300-900 cc] which consists of an elastomer component and a curing agent component, which a fiber strengthening resin ingredient member becomes from a carbon fiber strengthening epoxy resin, which a metallic material member becomes from a titanium alloy.

[0009]

[Embodiment of the Invention] Hereafter, this invention is explained in detail. It is large in the moment of inertia of a golf club head, and by enlarging the depth of a center of gravity, the deflection of a hit ball becomes small and the fall of the flight distance by it can also be made small. In order to enlarge the moment of inertia of a golf club head, and the depth of a center of gravity, there is the approach of enlarging the dimension of a golf club head, but swing etc. will become difficult, if the weight of a golf club head is also increased in case the dimension of a golf club head is enlarged. Therefore, as for the weight of a golf club head, 200g becomes an upper limit as a matter of fact. Then, for set the weight of a golf club head constant and enlarging a dimension, it is necessary to make structure of a golf club head hollow, and it is necessary to enlarge the volume as much as possible.

[0010] The volume whose place is the index which sets for example, golf club head weight to 200g, and shows the magnitude of a golf club head 300 cc, If the moment of inertia which is another index which shows the magnitude of a golf club head produces the large-sized hollow golf club head which is 3x10-4 kg-m2 only with metallic materials, such as a titanium alloy, an aluminum high tensile alloy, and stainless steel There is a possibility of thickness of a golf club head being made thin and destroying with the impact at the time of a blow. and moment of inertia -- 4x10-4 kg-m2 it is -- it is checked experimentally that there is a possibility of the part from which thickness, such as the face section, is set to 1mm or less arising if a still more large-sized golf club head is produced with these metallic materials, and actually producing breakage at the time of a blow.

[0011] This reason is that specific gravity is large and specific strength (tensile strength (kg/mm2)/specific gravity) is small in these metallic materials. 14-20kg /of specific strength of these metallic materials is [mm] 2, and the upper limit of the moment of inertia of a golf club head actually serves as 3x10-4 kg-m2 with the ingredient of specific strength of this level. Therefore, with the golf club head which consists only of a metallic material, it is very difficult to enlarge the dimension (volume) and to make moment of inertia more than into this, the depth of a center of gravity becomes small also as a configuration where only moment of inertia is [even if] big, and most degrees of freedom of a center-of-gravity location will be in the condition that it is lost and the optimal center-of-gravity location design cannot be performed.

[0012] There is a fiber strengthening resin ingredient as an ingredient with high specific strength. Especially as a with an or more [30kg //mm] 2 specific strength ingredient, a carbon-fiber-reinforced-plastics ingredient is suitable, and achievement also of moment-of-inertia 4x10-4 kg-m2 is attained. Flight distance and control nature are improvable by enlarging moment of inertia, combining it and enlarging the depth of a center of gravity by this. However, the golf club head which consisted of fiber strengthening resin ingredients is not enough compared with the golf club head made from the present titanium alloy in a hit ball sound and abrasion-proof nature. Then, in order to improve engine performance, such as a hit ball sound and abrasion-proof nature, a part of golf club head which consists of a fiber strengthening resin ingredient was replaced with the metallic material, and the view which is going to obtain the golf club head having the description of the both sides of a metallic material and a fiber strengthening resin ingredient which demonstrates the outstanding engine performance was born. This improves a hit ball sound and abrasion-proof nature in the part of a metallic material, and by use of a fiber strengthening resin ingredient, it is going to high-intensity-ize and it tends to presuppose that it is possible a light weight and to both enlarge the depth of moment of inertia and a center of gravity.

[0013] (Adhesives) Adhesion with a metallic material member and a fiber reinforced material member can obtain stable bond strength by setting adhesives thickness to 0.05-1mm. In less than 0.05mm, it is easy to start the thickness spots of an adhesives layer, and if it exceeds 1mm, it will become easy to produce the reduction of rigidity of an adhesives layer, and the outflow of adhesion resin.
[0014] Although it is possible to carry out also with liquid glue when pasting up a metallic material member and the hardened fiber strengthening resin ingredient member, in a solid configuration like a golf club head, it is necessary to pay sufficient attention to apply liquid glue by homogeneity thickness and width of face. Since the spreading spots of adhesives and thickness spots cause a bond strength fall, it becomes difficult to obtain the golf club head which has stable reinforcement.
[0015] Moreover, when pasting up a metallic material member and a non-hardened fiber strengthening resin ingredient member, it is also possible to pile up a metallic material member and a non-hardened fiber strengthening resin ingredient member through the adhesives of a film gestalt, and to paste up at the time of hardening of a fiber strengthening resin ingredient. Since the adhesives of a film gestalt have the thickness of homogeneity, it is hard to produce spots and they can obtain stable bond strength by pasting up by predetermined ******. As resin which constitutes the adhesives of a film gestalt, an epoxy resin, polyester resin, acrylic resin, etc. are mentioned, and an epoxy resin is desirable in respect of bond strength. It is still more desirable to contain an elastomer component as an epoxy resin presentation in addition to an epoxy resin component and a curing agent component. Carboxy-Terminated Butadiene Acrylonitrile Copolymer (CTBN) etc. is mentioned as an elastomer component.
[0016] By the base material with which the adhesives of a film gestalt furthermore consist of a nonwoven fabric or textile fabrics being included, the handling nature and adhesives holdout of adhesives of a film gestalt improve. Furthermore, since progress of a crack can be suppressed even if a minute crack occurs when the load of the stress is carried out to the adhesives layer after hardening, the disruptive strength of an adhesives layer can be raised.
[0017] As an ingredient of a nonwoven fabric and textile fabrics, although polyester fiber, nylon fiber, an aramid fiber, an acrylic fiber, a glass fiber, etc. can be used, it does not limit to this.
[0018] It is known that a golf club head will receive about 1t load for a ball in 5/10000 seconds at the time of a blow. In order to obtain the golf club head which has the endurance which bears this impact, it is necessary to use the adhesives which have the engine performance of 15 or more MPas with adhesion shear bond strength as adhesives to be used. Here, shear bond strength is Federal. Specification It is the value measured based on MMM-A-132B (1 April 1994).

[0019] (Fiber strengthening resin ingredient) In this invention, said effectiveness is done so by pasting up a metallic material member and a fiber strengthening resin ingredient member with a specific adhesion gestalt. Although the fiber strengthening resin into which matrix resin, such as an epoxy resin, an unsaturated polyester resin, and vinyl ester resin, was infiltrated is in strengthening fiber, such as a carbon fiber, a glass fiber, an aramid fiber, and polyester fiber, as a fiber strengthening resin ingredient which constitutes a fiber strengthening resin ingredient member, as strengthening fiber, a carbon fiber is desirable in respect of reinforcement.
[0020] The reinforcement which maintained balance because the direction of orientation of a carbon fiber considers as a false isotropy laminating, and combining a middle ingredient (0 degree, 60 degrees, and -60 degrees) can be obtained in that case. [combining the middle ingredient (prepreg) which are 0 degree, 90 degrees, -45 degrees, and 45 degrees] However, what is necessary is just to use a carbon fiber in the rectangular cross 2 direction (0 degree, 90 degrees) in a golf club head, combining the middle material which carried out orientation, in order to secure sufficient shock resistance on parenchyma. In the case of the carbon fiber 2 direction strengthening resin as this rectangular cross 2 direction orientation carbon fiber, can also use for an one direction the rectangular cross 2 direction textile fabrics besides 0 degree of the carbon fiber which carried out orientation, and 90-degree laminated wood, and using the epoxy resin as matrix resin, specific strength is 2 35-60kg/mm. A fiber strengthening resin ingredient can be obtained.

[0021] (Metallic material) As a metallic material which constitutes a metallic material member, although a titanium alloy, an aluminum high tensile alloy, and stainless steel are mentioned, a titanium alloy is desirable in respect of the balance of reinforcement and specific gravity. Cleaning processing is carried out and, as for the front face of the metallic material to paste up, it is [the granularity of a surface of metal] desirable that it is based on a methyl ethyl ketone, an acetone, etc. that it is Ra 1-20.
[0022] (The configuration of a golf club head, manufacturing method) It divides roughly and is divided into the parts of a face, a SOL, crown, and a neck, as shown in drawing 1 -6, a metallic material constitutes a face, a SOL, and a neck, and crown can be used as a fiber strengthening resin ingredient, and as shown in drawing 7 -11, as for a golf club head, considering as a metallic material etc. can combine and choose a face and a neck as arbitration.
[0023] How to produce the golf club head which consists of a metallic material member and a fiber strengthening resin ingredient member of the carbon fiber 2 direction strengthening epoxy resin is explained by the case where a metallic material constitutes a face, a SOL, and a neck. A metallic material member is beforehand fabricated with casting, forging, etc. Separately, need number-of-sheets decision of the carbon fiber 2 direction strengthening epoxy resin middle ingredient (prepreg) is carried out at a crown configuration. The adhesives of a film gestalt are cut out in the required configuration at least at jointing with the fiber strengthening resin ingredient member of a metallic material member. The laminating of said middle ingredient is carried out on it. The bag which consists of natural rubber etc. is inserted in the hole or metallic material member for shaft attachment which is in a neck inside a golf club head from the hole which also received another way, and a golf club head is set in a female and carries out [mold clamp].
[0024] Next, it hardens pressing pressurization air fit in said bag mostly at coincidence, and pressing a middle ingredient in a mold in front, if this mold is put into a heating furnace and heated, and the bonded structure shown in drawing 6 is acquired. Since a pressure is enough applied to the middle ingredient of adhesion, the middle ingredient which serves as a fiber strengthening resin ingredient member in the metallic material member which sandwiched the adhesives of a film gestalt in between, and the back can also be pressurized according to devices, such as preparing the movable pressurization section in the female inside.
[0025] When performing hardening of a fiber strengthening resin ingredient, and adhesion of both members to coincidence using non-hardened a fiber strengthening resin ingredient member and a metallic material member, it is also possible to consider as the inside instead of an outside of a metallic material member which mentioned a part for jointing above. In this case, as shown in drawing 12 , chamfer processing of the edge of a metallic material member can be carried out, while taking a large adhesion area of an edge, fiber crookedness of the middle ingredient used as a fiber strengthening resin ingredient member can be made to be able to ease, and reduction and improvement in on the strength can be aimed at for stress concentration. Moreover, it is also possible to prepare so that a part for jointing of a metallic material member and a non-hardened fiber strengthening resin ingredient member may be put by the metallic material member (drawing 13). It is also possible to paste up pressurizing the fiber strengthening resin ingredient member hardened beforehand with a metallic material with the adhesives of a film gestalt etc.
[0026] A titanium alloy is used as a metallic material and specific strength is 2 35kg/mm at carbon fiber content 50 volume % as a fiber strengthening resin ingredient. The carbon fiber 2 direction strengthening epoxy resin is used. Furthermore, if a hollow golf club head with a volume [of 400 cc] and a weight of 190g is produced using the adhesives of a film gestalt as adhesives Moment of inertia can give the moment of inertia of 4x10 to 4 kg, m2, a next door, and sufficient magnitude to a golf club head, and can also set up the depth of a center of gravity sufficiently greatly. And since adhesion shall have sufficient reinforcement, there is no fear of destruction of the golf club head by the impact at the time of a blow. In addition, specific strength is 2 30kg/mm in addition to the carbon fiber 2 direction strengthening epoxy resin. It has the above value, and as an ingredient which can be used for the golf club head of this invention, although it is expensive, there is a carbon fiber strengthening graphite composite material (C/C composite) etc.

[0027] Thus, the golf club head of this invention can set the volume to 300 cc or more, can enlarge the depth of moment of inertia and a center of gravity compared with the conventional thing, and is the value of moment of inertia preferably 4x10-4 kg-m2 It is considering as the above. Therefore, even when it separates a little from the sweet spot of the face of a golf club head and a ball is hit, the deflection of a ball is small, and the fall of the flight distance by the deflection of this ball can be made small. It is also possible to prepare a balance weight for center-of-gravity adjustment.
[0028] (Example 1) It consisted of a titanium alloy and the metallic material member (it considers as a golf club head and illustrates to volume of 400 cc and drawing 1) constituted considering the face, the SOL, and the neck as one was prepared. It is only called a titanium member below.
[0029] on the other hand -- prepreg [-- after judging PAIRO philharmonic TRby Mitsubishi Rayon Co., Ltd.350H150(carbon fiber content 35 volume %)] in a crown configuration, the six-sheet laminating was carried out by turns so that the direction of orientation of fiber might become 0/90 degree, and the fiber strengthening resin ingredient member which constitutes crown was prepared. Hereafter, it is only called a fiber strengthening resin ingredient member.
[0030] and -- as the adhesives of a film gestalt -- the product made from Newport ADOHESSHIBU -- NB-101 (0.3mm in shear bond strength 30MPa, thickness) was prepared.
[0031] The laminating of the adhesives of a film gestalt was carried out to the adhesion part with the titanium member of a fiber strengthening resin ingredient member. The nylon bag manufacture for applying internal pressure through the neck of a titanium member has been arranged, and the temporary laminating of the fiber strengthening resin ingredient member which carried out the laminating of the adhesives of a film gestalt was carried out to titanium member external surface, it has arranged in 2 rate female for shaping, and eye a mold clamp was performed.
[0032] This female was put into the heating furnace, and while heating on the temperature of 120 degrees C, and the conditions of time amount 2 hours, pressurization air with a pressure of 3kg/cm2 was pressed fit in nylon bag manufacture. After hardening, the mold was broken and the target golf club head was obtained.
[0033] The weight of this golf club head was [the depth of 4.0x10-4 kg-m2 and a center of gravity of 190g and moment of inertia] 38mm. The shaft for golf clubs was attached in this golf club head, and it considered as the golf club. This golf club was attached in the swing robot, and in head speed 48m/a second, even if hit repeatedly, 1000 things to damage could not be found. Moreover, when the field trial by the swing robot was presented with this golf club in head speed 40m/a second, it was checked that concentrated on the range of several m of the landing point 200m away from the tee shot point, and the ball has fallen. Also in the trial by the examiner, the blemish produced on the golf club head is also extent which usually appears in a titanium alloy, and the feel more near the golf club head made from a metallic material was acquired also in the hit ball sound.
[0034] (Example 2) as the adhesives of a film gestalt -- the product made from a SAITEKKU fiber light -- the ingredient of FM73M (0.1mm in shear bond strength 30MPa, thickness) was used, and also the golf club head was fabricated like the example 1, and the golf club head was obtained. In head speed 48m/a second of a durability test, it turned out that sufficient reinforcement is obtained.
[0035] (Example of a comparison) As adhesives of a film gestalt, EPC 030-320 (0.02mm in shear bond strength 10MPa, thickness) by Nitto Boseki Co., Ltd. was used, and also the golf club head was fabricated like the example 1, and the golf club head was obtained. In head speed 48m/a second of a durability test, it turned out in the plane of composition of a titanium member and a fiber strengthening resin ingredient member that exfoliation arises and a problem is in endurance.

[0036]
[Effect of the Invention] If it is in the golf club head of this invention as explained above, compared with the former, the deflection of a hit ball is very small, there is also no fall of the flight distance by this, and, moreover, the golf club having the engine performance near the golf club head made from a titanium alloy can be obtained in a hit ball sound and abrasion-proof

nature.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Golf club head front view
[Drawing 2] It illustrates in accordance with the depth of a golf club head plan and a center of gravity.
[Drawing 3] Golf club head right side view
[Drawing 4] Golf club head bottom view
[Drawing 5] Golf club head left side view
[Drawing 6] Golf club head sectional view
[Drawing 7] Golf club head front view
[Drawing 8] Golf club head plan
[Drawing 9] Golf club head right side view
[Drawing 10] Golf club head bottom view
[Drawing 11] Golf club head left side view
[Drawing 12] Golf club head sectional view
[Drawing 13] Golf club head sectional view
[Description of Notations]
100 Golf Club Head
101 Golf Club Head Fiber Strengthening Resin Ingredient Member
102 Golf Club Head Metallic Material Member
200 Golf Club Head
201 Golf Club Head Fiber Strengthening Resin Ingredient Member
202 Golf Club Head Metallic Material Member
A Profile line
300 Golf Club Head
301 Fiber Strengthening Resin Ingredient Member
302 Metallic Material Member
400 Golf Club Head
401 Fiber Strengthening Resin Ingredient Member
402 Metallic Material Member
500 Golf Club Head
501 Fiber Strengthening Resin Ingredient Member
502 Metallic Material Member
600 Golf Club Head
601 Fiber Strengthening Resin Ingredient Member
602 Metallic Material Member
603 Adhesives
700 Golf Club Head
701 Fiber Strengthening Resin Ingredient Member
702 Metallic Material Member
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1100 Golf Club Head
1101 Fiber Strengthening Resin Ingredient Member
1102 Metallic Material Member
1200 Golf Club Head
1201 Fiber Strengthening Resin Ingredient Member
1202 Metallic Material Member
1203 Adhesives
1300 Golf Club Head
1301 Fiber Strengthening Resin Ingredient Member
1302 Metallic Material Member
1303 Adhesives

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